

Preparing for extended space flight:

Psychology and human behavior

As lengthy stays aboard the International Space Station begin, and plans for potential missions to Mars begin to unfold, the need for a better understanding of the psychological issues that crewmembers will face on orbit becomes evident.

A number of psychological issues must be considered when preparing for long-duration space missions. Psychological aspects associated with crew health, well-being, productivity and teamwork become increasingly significant. And the necessity for meaningful work versus “make work,” reasonable work-rest schedules, and communication capabilities all must be considered when preparing crews.

These and other psychological factors are all interrelated and all play key roles in the success of long-duration missions. Together they form the cornerstone of behavioral health and human performance.

The responsibility for defining these complex issues, preparing crews for long-duration space flight from a psychological perspective, and developing treatments for deleterious effects that they may experi-

ence belongs to the psychologists in JSC’s Space and Life Science Directorate and the contractor personnel who support them. Together they make up the Behavioral Health and Performance Group.

“In general, this field is in its youth

because the U.S. hasn’t done much long-duration space flight other than Skylab, the Mir series and some extended simulations,” said Dr. Al Holland, NASA/JSC chief of psychology. “What we know we know from these and from analogue environments such as polar expeditions. We certainly don’t have the experience the Russians have, but even they still have some outstanding issues in terms of managing behavior, well-being and performance in flight. We know how to do a two-week duration aboard the shuttle safely, and we can do three-month tours of duty in space. A six-month stay in space is probably the longest envelope that we currently understand.”

Analogue Environments

The experiences of individuals who have lived and worked in polar regions and aboard the Mir space station have helped the psychologists formulate their training plans for the ISS crews.

Dr. Joanna Wood, a visiting scientist at JSC from Baylor College of Medicine, has done some work in the Australian polar stations in Antarctica. Every year since 1996, she has participated in an annual training camp held in Tasmania where future Antarctic expedition members gather together for a week at a fishing camp to train in preparation for their stays in the Antarctic.



NASA Photo STS071-E-0006

Cross-cultural training plays a key role in preparing crews for mission success. Aboard Russia’s Mir Space Station, Astronaut Dr. Bonnie Dunbar, STS-71 mission specialist, shakes hands with Cosmonaut Gennadiy Strekalov, Mir-18 flight engineer. Looking on are Cosmonaut Nikolai Budarin (left), Mir-19 flight engineer, and Astronaut Robert Gibson, STS-71 commander.

Wood views these polar expeditions as insightful analogues to long-term space travel. “So far we have identified some of the major problems and issues that arise with groups living in extreme environments and some of the things that people do to deal with the problems. These can be passed off immediately to work into training flows for crews. We are going farther to look at more complex situations and look at the interplay between individual and group characteristics to help figure out who would make the best groups. How do you get a good group? Do you train it into them or does the chemistry have to be there initially?”

Research conducted thus far has shown that no two groups are the same and that no person working in a group has the same experience twice because one’s experience depends upon the group one is with. “Teams in extreme environments have to live together – it’s not just working,” Wood says.

Another lesson learned from studying people living and working in extreme environments is the importance of selecting the right individuals to participate in the expeditions.

“These are normal people going into an abnormal set of circumstances,” said Wood. “We all have only so many items in our emotional repertoire. We’ve got only so many emotions we can feel, and by the time we are adults, we already have our preferred coping mechanisms. We may learn about some others; we may even try them out. But when times get tough, we go back to what we know. So hopefully they will pick people who know some positive things to do – people who have demonstrated that they can cope with unusual situations.”

In addition to the study of those who have lived and worked in polar regions, the

lessons learned from the Mir series have proved beneficial to the psychologists.

“Mir was a remarkable learning experience in this discipline,” said Holland. “Unfortunately there are only seven people upon which to base the lessons that we’ve learned. And so it’s not a research base – it’s an anecdotal experience base. But it was very helpful in preparing for ISS because the ISS missions are no longer in duration than the Mir missions and that’s a big driver for psychological issues.

“One of the major lessons that we learned from Mir was the impact of the ground organization on the psychological health, well-being and performance of the individual crewmembers. The organization can consciously improve the individual’s health as well as unconsciously negatively impact that well-being through its normal operations. It is very important to make ground personnel, including management, aware of the very sizable impact that they can have on the individual crewmember’s psychological well-being. That was the biggest lesson from the Mir series.”

Astronaut Selection and Training

In all types of missions – space, polar, military, ground studies – many factors influence who is actually assigned to a mission, and psychological information is only one part of the overall selection process. Within that part, individuals are selected who are psychologically suited for the target mission and who work well together as a team. The determination of individual suitability and team compatibility for long-duration missions is a long, involved process that involves psychological testing, structured reference interviews, skill-based training and selection exercise, formal briefings, individual strategy sessions, and other evaluations.

The “select-out” testing and interview process addresses the clinical psychological fitness of potential candidates, and the “select-in” testing and interview process addresses the psychological suitability of each candidate for the target mission. The main areas for psychological training of

crewmembers are individual adaptation, well-being, performance and health issues. The second area would be leadership under conditions of extended, confined operations. The third major area would be team issues – team cohesion and effective team process. Finally, there are the cross-cultural issues that are embedded in individual, team and leadership areas.

Astronaut candidates, astronauts and Expedition crews get an overview of the psychological factors of long-duration space flight. They are given the psychological training that they will need to be effective in the isolated, confined environment they will face.

“There are certain phenomena that tend to occur to many people during long-duration confined operations,” said Holland. “The training that the astronaut candidates receive lets them understand that, when they do fly and experience these problems, they are not experiencing something new and unusual. The training also helps them understand how people have dealt with these concerns.

“One example of individual adaptation would be what might be considered a psychological counterpart to putting blinders on a horse. Within the first six weeks of a long-duration mission, an individual makes an adaptation to the new environment of the closed vessel and comes to terms with the fact that he or she will be in this spacecraft with these same people for a long time. In general, there seems to be a need for crewmembers to limit themselves. They learn to pay less concentration and less attention to the world outside of the spacecraft. It’s a necessary limitation or a coding down of the size of their world so that they can make the investment necessary to make the spacecraft a happy place. Crewmembers are usually much happier once they go through this adaptation process.”

The training that Expedition crews one through four have received primarily covers psychological insight and support, team processes and cross-cultural training. It has not included a lot of the

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